(12) UK Patent Application (19) GB (11) 2 235 767 (13) A

(43) Date of A publication 13.03.1991

(21) Application No 9018582.8

(22) Date of filing 24.08.1990

(30) Priority data
(31) 8911219 (32) 24.08.1989 (33) FR

(51) INT CL[5]
G01N 21/47

(52) UK CL (Edition K)
G1A AC1 ADK AD10 AD4 AG10 AG15 AG16 AG17 AG7 AP1 AP9 AR7 AS3 AT14 AT21 AT3
U1S S1288

(56) Documents cited
GB 2103359 A WO 88/05284 A1 WO 87/01948 A1

(58) Field of search
UK CL (Edition K) G1A AAM ACD ADK
INT CL[5] A61B, G01N
Online database: WPI

(71) Applicant
L'Oreal

(Incorporated in France)

14 rue Royale, 75008 Paris, France

(72) Inventors
Roland Michel Gabriel Bazin
Véronique Delvigne
Gerard Obadia
Louis Marcotte

(74) Agent and/or Address for Service
J A Kemp & Co
14 South Square, Gray's Inn, London, WC1R 5LX, United Kingdom

(54) **Quantifying the behaviour of the skin in relation to solar radiation**

(57) To quantify the behaviour, in relation to solar radiation, of skin to which a cosmetic product has been applied, a zone (4) of the skin to be examined is illuminated with UVA radiation and the intensity of the UVA radiation reflected along an angle (*r*) different from the angle of specular reflection is measured so as to eliminate the specular reflection to the maximum extent and to evaluate essentially the diffused reflection. Light from a halogen lamp (2) strikes the zone (4) normally after passing through a UVA filter (3), and the reflected light is detected by a plurality of photodiodes (11) regularly spaced around the zone (4). Other detectors (7) measure the lamp intensity, and the assembly of lamps and detectors is carried in a casing (fig 3) cooled by a fan.

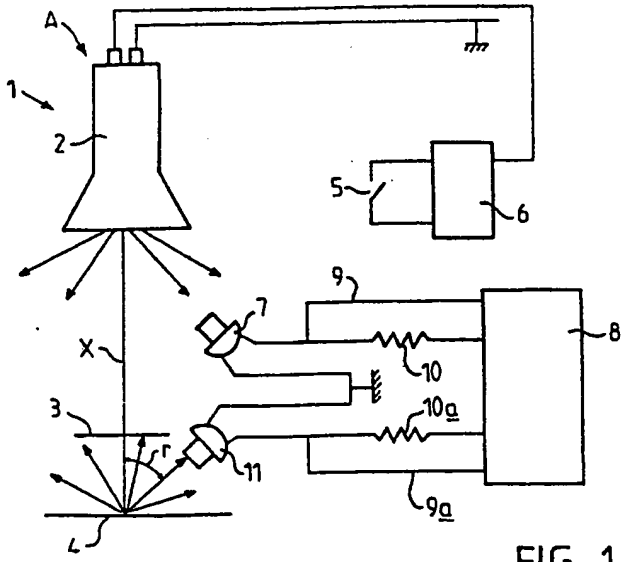

FIG. 1

GB 2 235 767 A

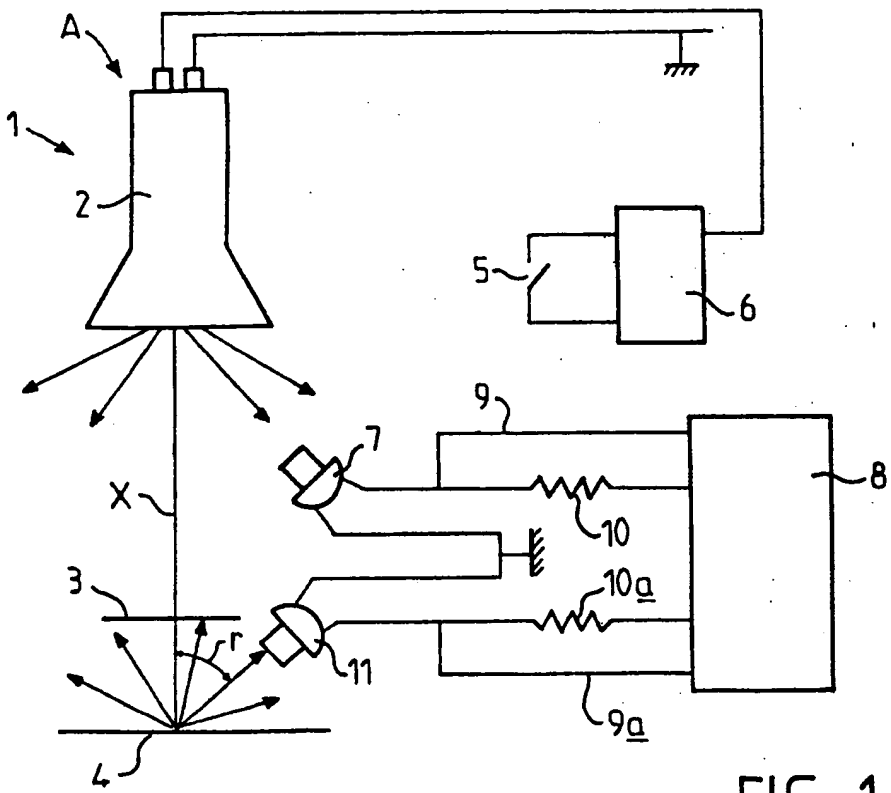

FIG. 1

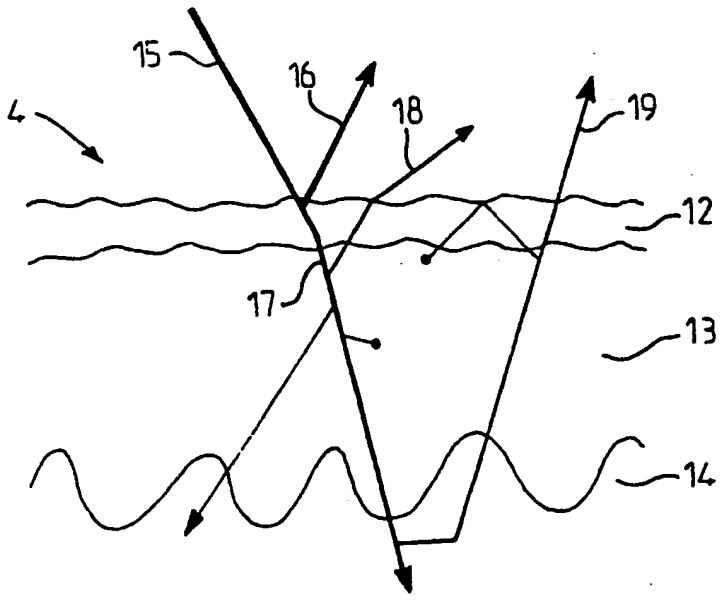

FIG. 2

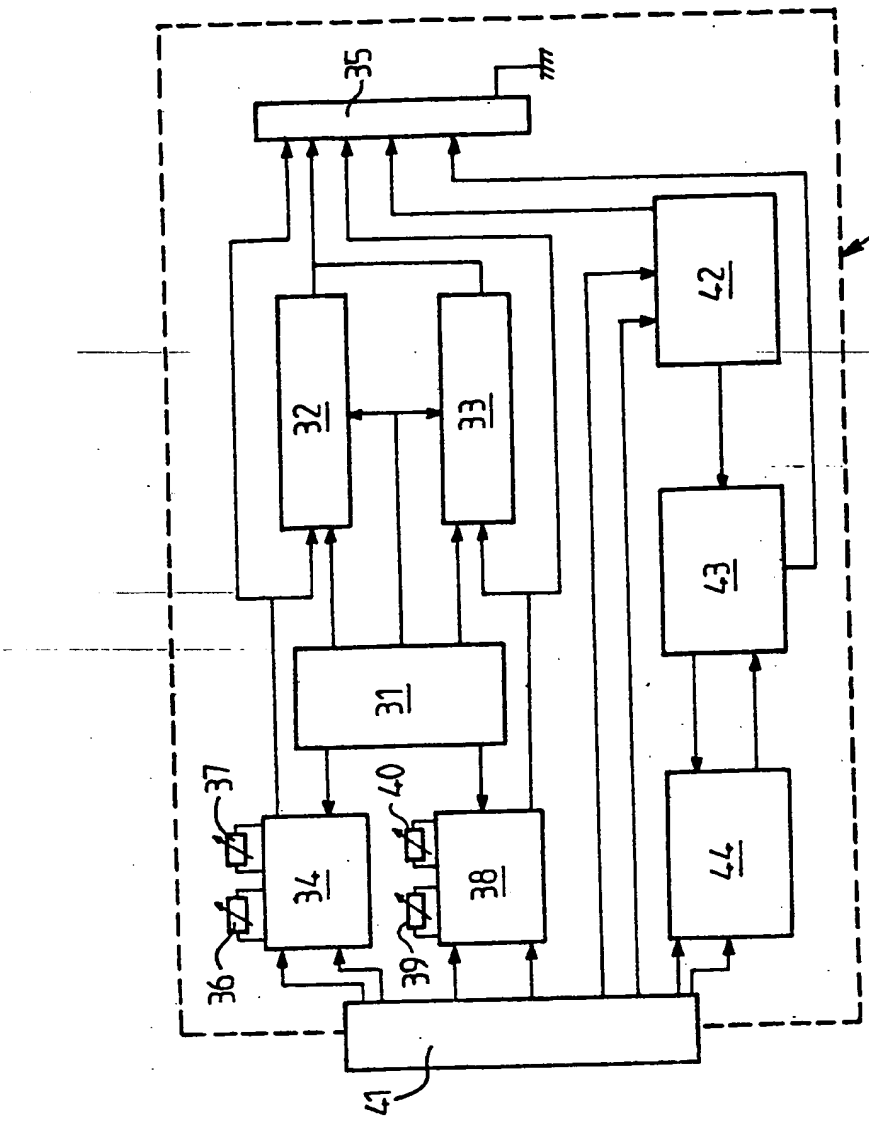
35
8
42
32
33
43
31
37
40
34
38
44
36
39
41

FIG. 4

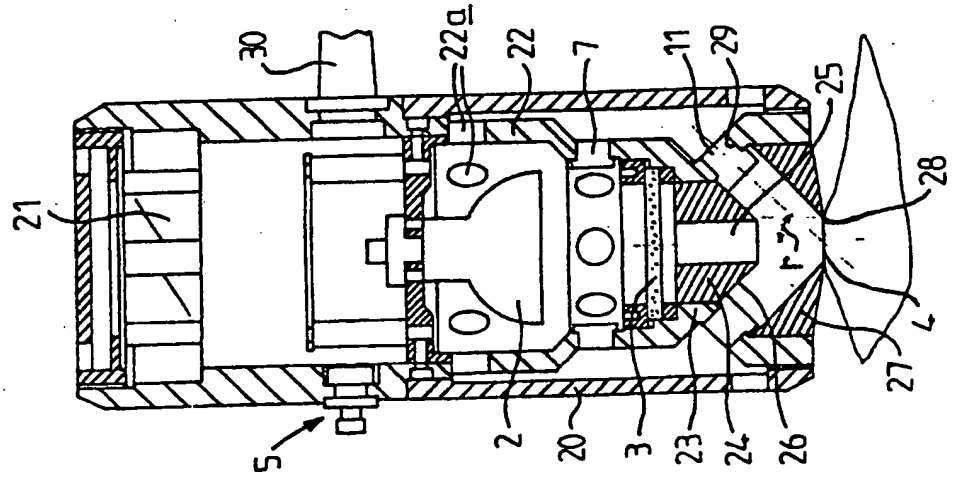
30
22a
22
7
11
29
25
28
21
27
5
2
20
3
23
24
26

FIG. 3

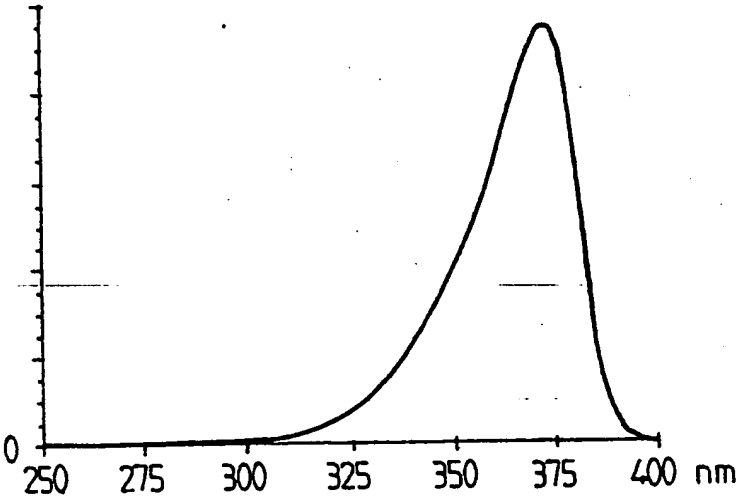

FIG. 5

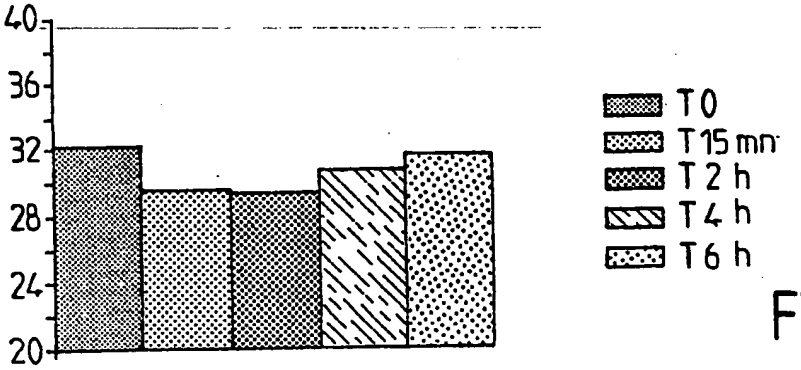

FIG. 6

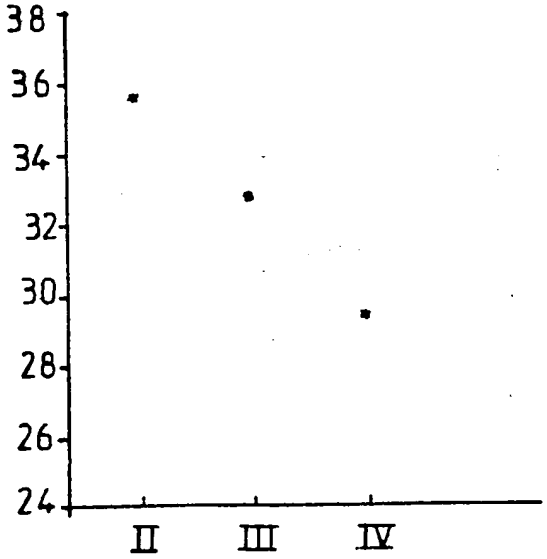

FIG. 7

A METHOD FOR QUANTIFYING THE BEHAVIOUR OF THE SKIN IN RELATION TO SOLAR RADIATION, AN APPARATUS FOR THE IMPLEMENTATION OF THIS METHOD, AND APPLICATIONS THEREFOR.

The invention relates to a method for quantifying the behaviour, in relation to solar radiation, of skin on which a cosmetic product has optionally been applied.

It is known that the problem of evaluating the behaviour of the skin in relation to solar radiation is complicated but very important, in particular for formulating products for application to the skin with a view to ensuring a satisfactory sunburn protection. It is also desired to discover the capacity of the skin to resist ageing produced by solar radiation.

Various methods known to date allow an evaluation of skin behaviour to be carried out, but they need to be improved.

A first example of a known method lies in exposing the skin to a UVB radiation (wavelength range 280nm - 320 nm) until an erythema of the skin is produced. The measurement of the exposure time until the appearance of this erythema for a given intensity of radiation permits a certain quantification of the skin behaviour to be made in relation to the solar radiation. This method, which involves a visual appreciation of the erythema is relatively empirical and yields approximate results.

WO 88/05284 concerns an apparatus for the determination of a solar protection index. This apparatus comprises means for measuring the sensitivity of the skin, capable of illuminating a zone of the skin, preferably with a luminescent diode emitting a green light at a wavelength of 560 nm, and which are capable of measuring the radiation reflected by the melanic layer.

Such an apparatus, while allowing measurements to be carried out, is not entirely satisfactory, since on the one hand, it operates on wavelengths of 560 nm whose action

on the skin is of minor importance and, on the other hand, it does not differentiate to any marked extent between specular and diffused reflection.

Indeed, it has been found that the fraction of solar radiation which has the greatest effect on the ageing of the skin is that corresponding to a wavelength range of 320 nm - 400 nm, that is to say, that corresponding to UVA radiation.

On the basis of the invention, it has, moreover, been found that the capacity of specular reflection of the skin in response to UV radiation is substantially the same for the different kinds of skin, while the capacity of diffused reflection in response to UV radiation differs substantially from one type of skin to another, and that the diffused reflection predominates over specular reflection.

This diffused reflection results from the set of reflections coming from all the cutaneous interfaces encountered by the incident light beam, and is effected in various directions, while the specular reflection mainly takes place along a direction of reflection symmetrical to the incident direction in relation to the normal to the reflection surface.

According to one aspect of the invention there is provided a method for quantifying the behaviour, in relation to solar radiation, of skin on which a cosmetic product has optionally been applied, comprising illuminating with UVA radiation a zone of the skin to be examined, and measuring the intensity of the UVA radiation reflected along a direction inclined at an angle different from the angle of specular reflection, so as to eliminate the specular reflection to the maximum extent and to evaluate essentially the diffused reflection.

Advantageously, the incident beam of UVA radiation is directed along a direction normal to the zone to be examined and the intensity of the reflected UVA radiation is measured along a direction inclined at 45° in relation to

the incident direction.

Preferably, the skin zone to be investigated is illuminated for a limited period, in particular, for less than 1 minute.

The invention also relates to an apparatus for carrying out the method defined above.

Accordingly a second aspect of the invention provides an apparatus for quantifying the behaviour, in relation to skin radiation, of skin on which a cosmetic product has been applied comprising a source of UVA radiation disposed so that its beam is directed towards the zone of the skin to be investigated, and at least one reflection photoreceiver disposed so as to receive the UVA radiation reflected by the skin along an inclined direction allowing the specular reflection to be eliminated to the maximum extent, and to evaluate essentially the diffused reflection.

Preferably, the axis of the light source is disposed orthogonally to the skin zone to be investigated whilst the or each reflection photoreceiver is orientated along a direction inclined at an angle inclined at approximately 45° in relation to the axis of the light source.

This light source is advantageously constituted by a directional halogen lamp with a wide spectrum and high output for a small size. This lamp produces a diffused light. The lamp is combined with a UVA filter capable of allowing only UVA radiation to pass. This UVA filter is advantageously that available from the SCHOTT Company and known under reference UG11.

Preferably provision is made for several reflection photoreceivers to measure the reflected intensity, these photoreceivers being disposed round the axis of the light source, and spaced at regular angular intervals. There may, in particular, be eight reflection photoreceivers for UVA radiation.

The apparatus comprises incident photoreceiver means capable of measuring the intensity of the light emitted by the source, to allow a comparison with the intensity of the reflected light.

The incident photoreceivers, as well as the reflection photoreceivers are in particular constituted by photodiodes sensitive to UVA; if these photodiodes are not already equipped with UVA filters and heat insulating filters, such filters will be disposed in the path of the incident light, in order on the one hand to allow only UVA light to pass, and on the other hand to prevent heating of the diode. The photoreceivers may also be constituted by photoresistors sensitive to UVA.

The apparatus preferably comprises a head comprising a cylindrical casing provided in the upper part with a halogen lamp and, in its lower half, with a support for (i) the incident photoreceivers recessed in a cylindrical wall of the support and orientated radially, (ii) the UVA filter disposed against a constriction of the support, and (iii) a sleeve comprising inclined cylindrical ducts regularly interspaced in correspondence with the reflection photoreceivers.

The apparatus includes a timing unit, actuated in particular by a push button, capable of illuminating the light source for a relatively short period, ranging in particular from one to thirty seconds. The apparatus comprises memory means, provided with digital display units, capable of storing and displaying the data relating on the one hand to the emitted intensity and on the other hand, to the reflected intensity before the source is extinguished. Provision is made for calculating means in the apparatus for establishing from these data a reflection percentage of UVA radiation by comparison with a predetermined scale.

The invention also concerns applications of the method defined above.

A first application lies in quantifying the

capacity of reflecting UVA radiation according to the phototype of the subject.

It has thus been possible to establish a significant correlation between the skin reflection percentage and the attributed phototype.

Another application lies in quantifying the potential for protection against solar radiation of a product applied to the skin, as well as its persistence and endurance after being subjected to mechanical, biological and chemical stresses or any other occurrence capable of altering the presence of the product on the skin.

Finally, the method according to the invention allows the protection index of a product in relation to UVA to be determined by means of the reflection capacity of this product measured with the apparatus in accordance with the invention. At present, there exist two methods for evaluating the protection coefficient of a substance in relation to UVA. they both have important drawbacks; indeed, the first (the erythematogenic phototoxic method) requires the topical use of a phototoxic substance and does not allow immediate reading; the second method (the photooxidative pigmentogenic method) is only applicable to certain phototypes, and the reading of the pigment response is made difficult because of the thermal erythema.

Apart from the arrangements set out above, the invention includes a certain number of other arrangements, which will be more explicitly discussed below in connection with an exemplary embodiment described with reference to the attached drawings, but which is in no way restrictive.

Figure 1 of these drawings is a simplified circuit diagram of an apparatus in accordance with the invention;

Figure 2 is a diagram illustrating the various reflection and diffraction phenomena of the light beam falling on a zone of the skin;

Figure 3 is a vertical axial section of an embodiment of an apparatus head in accordance with the

invention;

Figure 4 is a circuit diagram of the electronic circuits of an apparatus according to the invention, associated with the head of Figure 3;

Figure 5 is a graph illustrating the spectral distribution of the incident light, after passing through a UVA filter, the wavelengths expressed in nm (nanometers) being plotted on the x axis, whilst the intensity is plotted on the y axis;

Figure 6 is a graph illustrating the endurance effect of a product; and

Figure 7, finally, is a graph illustrating a classification of phototypes.

Referring to the drawings, in particular to Figure 1, there may be seen an apparatus A in accordance with the invention, allowing the behaviour of the skin to be quantified in relation to solar radiation, comprises a source 1 of UVA radiation constituted by a directional halogen lamp 2 with a wide spectrum, combined with a UVA filter 3 disposed in the incident light path and capable of allowing only UVA light to pass. Such a filter can, for example, be that manufactured by the SCHOTT Company and designated by the reference UG-11.

The spectrum of the incident light coming from the halogen lamp 2, after having passed through the filter 3, is illustrated in Figure 5 representing the intensity, plotted on the y axis according to the wavelength plotted on the x axis. It will be seen that the intensity of the incident beam is concentrated in the wavelength range of 320 nm to 400 nm, which corresponds to UVA.

The halogen lamp 2 has several advantages as compared with the conventional UV radiation lamps. The halogen lamp is small in size and operates with a low voltage, which simplifies the insulation problems. The lamp 2 produces a diffused illumination spread over a surface of approximately 1 cm^2, corresponding to the surface

of the examined skin.

In contrast to the halogen lamp, conventional UV lamps are in general large in size and are moreover dangerous because of residual UVC effects. Moreover, conventional UV lamps require a high voltage which involves problems of insulation.

The starting of the lamp 2 may be actuated by a push button 5 which starts a timing unit 6 ensuring the power supply for the lamp 2 for a limited and advantageously adjustable period ranging from one to thirty seconds.

The axis X of the lamp 2 is disposed orthogonally to the zone 4 of the skin to be investigated.

Provision may be made for at least one incident photoreceiver 7 to measure the intensity emitted by the lamp 2 and to receive a portion of the incident light beam. The photoreceivers 7 are advantageously constituted by UVA sensitive photodiodes. If the latter are not already equipped with UVA and heat insulating filters, such filters will be disposed in the path of the incident light in order on the one hand to allow only UVA light to pass, and on the other hand to avoid heating of the diode.

As a variant, the incident photoreceivers 7 may be constituted by UVA sensitive photoresistors already provided with a UVA- and heat-insulating filter.

The apparatus comprises an electronic unit 8, one terminal whereof makes it possible for the photoreceiver 7 to be energized via a link line 9; another terminal of the unit 8 is connected to the live terminal of the photoreceiver 7 via an electric resistor 10 allowing a signal representing the incident light intensity striking the photoreceiver 7 to be obtained. The other terminal of the photoreceiver 7 is earthed.

Provision is made for at least one reflection photoreceiver 11 for measuring the intensity of the UVA radiation reflected by the surface 4 along an angle r, making it possible to eliminate the specular reflection to

the maximum extent and to evaluate essentially the diffused reflection.

The angle r between the direction of the photoreceiver 11 and the normal to the surface 4 is different from the specular reflection angle which in the example under consideration is zero, since the axis of the incident beam is normal to the surface 4. It will be recalled that the specular reflection is greatest for a reflection angle equal to the angle of incidence.

The angle r between the direction of the axis of the reflection photoreceiver 11 and the normal to the surface 4 is preferably equal or substantially equal to 45°, which makes it possible to evaluate essentially the diffused reflection.

The photoreceiver 11 is connected (similarly to the photoreceiver 7) to terminals of the electronic unit 8 via a line 9a and a resistor 10a, and to earth.

Reference will now be made to the diagram of Figure 2 illustrating the phenomena of reflection and re-emission in the vicinity of a skin zone 4 constituted (passing from the outside towards the inside) by the horny layer 12, the living epidermis 13 and the dermis 14.

When a light beam 15 reaches the surface of the zone 4, a proportion 16 thereof is reflected by the horny layer 12 at an angle of reflection equal to the angle of incidence. Another proportion 17 penetrates into the skin where it is subjected to the phenomena of diffraction and absorption. A fraction 18 is re-emitted by the epidermis at an angle different from that of the specular reflection. Another fraction 19 corresponding substantially to the diffused reflection is re-emitted by the dermis. It is these fractions 18 and 19 which are essentially taken into account by the apparatus A in accordance with the invention.

As far as an incident UVA radiation is concerned, it has been shown that these fractions 18 and 19 permit a proper evaluation of the skin behaviour in relation to the UVA

fraction of the solar radiation.

With an apparatus in accordance with the invention it has been found that the measured intensity of the diffused reflection permits a quantification of the skin behaviour, making it possible to find and define a phototype classification related to that set out below.

Figure 3 illustrates an embodiment of an apparatus head in accordance with the invention. This head comprises a cylindrical casing 20 provided in its upper part with the halogen lamp 2 disposed coaxially with the casing. The casing 20 is provided in its upper portion with a fan 21 and openings allowing a circulation of cooling air to be set up inside the casing. A support 22 whose shape is shown in Figure 3 is provided in the lower half of the casing 20 to support the incident photoreceivers 7 recessed in a cylindrical wall of the support 22 substantially halfway up it and being radially orientated. There are two of these photoreceivers 7 regularly interspaced to allow the intensity of the incident light to be measured.

The upper end of the support 22 surrounds the lamp 2 and is provided with holes 22a for a circulation of air.

The UVA filter 3 is disposed orthogonally to the axis of the casing 20 and is held against a constriction 23 of the support 22 on the side of the photoreceivers 7 remote from the lamp 2. A sleeve 24 is mounted in the constriction 23 and comprises a central cylindrical duct 25 with a smaller diameter delimiting the aperture of the incident beam on the surface 4. The sleeve 24 comprises eight regularly interspaced cylindrical ducts 26 inclined at 45° in relation to its axis. These ducts 26 are directed towards the lower end of the sleeve 22 formed by a kind of thick washer 27 comprising a central aperture 28 with a small diameter, for example of the order of one centimetre. This aperture 28 can be applied to the surface 4 to be investigated and can determine the zone over which the measurement is effected. Eight reflection photoreceivers 11

are regularly distributed round the axis of the casing 20 and are disposed in recesses 29 provided in the support 22 near the top of the ducts 26. The axes of the photoreceivers 11 are situated over a cone of revolution authorizing an angle $r = 45°$ as the half angle at the top, and with its axis identical to that of the casing 20.

A cable 30 penetrates radially into the upper portion of the casing 20 and comprises leads for the electric power supply 4 for the lamp 2 and for the connections between the various photoreceivers 7 and 11 and electronic means 8 whose circuit diagram is shown in Figure 4.

The push button 5 controlling the illumination of the lamp 2 is also provided in the cylindrical wall of the casing 20 in the upper portion so as to project radially.

As illustrated in Figure 4, the electronic means 8 comprise a unit 31 for energizing the photoreceivers 7 and 11; this unit 31 also ensures the power supply for, and the control of, the display circuit 32, 33 respectively for the reflective flux and for the incident flux.

The reflection photoreceivers 11 are supplied via a conditioning circuit 34 which comprises moreover an amplifier capable of receiving and amplifying the signal coming from the photoreceivers 11 and capable of passing at their output this signal, representing the reflected intensity, to the display means 32 and to a terminal of a connector 35. Means 36, 37 constituted in particular by potentiometers are provided for the setting of the delay and the gain of the amplifier of the conditioning circuit 34.

Provision is made for a conditioning circuit 38, similar to the circuit 34, to supply the photoreceivers 7 and to process the signal produced by these photoreceivers, to pass this signal to the means 33 for displaying the incident flux, and to another terminal of the connector 35. Potentiometers 39, 40 are provided for the setting of the delay and of the gain of the conditioning circuit 38.

The circuits 34 and 38 are connected to terminals of a connector 41 and themselves intended to be connected to the respective photoreceiver. Provision is made for a circuit 42 for actuating the lamp 2. This circuit may comprise a timer unit started by the push button, and having two terminals connected to the terminals of the connector 41. This circuit 42 comprises an output connected to a circuit 43 for adjusting the strength of the supply current of the lamp 2. This lamp 2 is energized via a circuit 44 subject to the control of the circuit 43. The electric power supply for the fan 21 is also ensured by the circuit 44 whose two terminals are connected to the connector 41.

The circuit 43 for adjusting the lamp is connected to a terminal of the connector 35 as is the circuit 42 for actuating the lamp. The connector 35 is provided for connection to a minicomputer which would then take over the management of the measurements and of the functioning of the apparatus in accordance with the invention.

This apparatus allows the method of the invention to be implemented as follows.

As illustrated in Figure 3, the head of the apparatus is applied to the zone 4 of the skin to be investigated.

A measurement is then started by pressing on the push button 5 which produces UVA irradiation of the zone 4 and the measurement of the amount of reflected light with a display of the results. This measurement method is simple, non-invasive and can be applied *in vivo* and *in vitro* to evaluate the behaviour of the skin in relation to solar radiation in particular as regards UVA.

Numerous applications of the method are possible.

For example, the apparatus allows the quantifying of the "sunburn protection" potential, its persistence, and endurance, of a product intended to be applied to the skin.

A result of tests and measurements effected in connection with the diagram of Figure 6 is given below.

The object of the measurements was to determine the UVA protective capacity of a make-up foundation, and the persistence of this capacity with respect to time. The protective capacity has been evaluated by the apparatus in accordance with the invention in vivo, by noting the reflection percentage of the skin of the made-up face. The record of the measurements was as follows.

A reflection measurement was effected on the bare skin without make-up or skin care products, at the time TO. The skin of the face was then made up with the foundation make-up at a rate of 1 mg/cm^2.

Reflection measurements were taken fifteen minutes after the application, then two hours, four hours and six hours later.

The investigation was conducted with seven models of phototypes II and III (see below). The parameter recorded during the measurements was the reflection percentage. This reflection percentage was calculated from the skin measurements, taking into account the calibration curve of the apparatus. This curve was obtained by the measurement of various standard reflection indices. This parameter corresponds to the capacity of the measured surface to reflect the UVA radiation emitted by the lamp 2 and filtered by filter 3.

The results are set out in the table given below.

TIME	REFLECTION %
TO	32.28
T15mn	29.59
T2h	29.51
T4h	30.82
T6h	31.77

If the surface of the skin is covered by a product capable of absorbing the photons, the reflection percentage

will decrease in relation to the same bare surface. This is indeed what has been found.

An analysis of the variance followed by a multiple comparison indicates on the one hand that the make-up by the foundation base persists in the UVA range until T4h. However, only the comparison between the T15 mn value after the application and the T6h value shows a significant variation.

Moreover, the comparison between the bare skin and the made-up skin with respect to time indicates a significant difference of the UVA reflection capacity for the times of T15 mn and T2h after the application.

The results of these tests, summed up in the diagram of Figure 6 where the time is plotted on the x axis and the reflection capacity on the y axis, permit the conclusion that the make-up of the facial skin by the foundation base persists *in vivo* up to T4h.

The capacity of the made-up skin of the face of filtering the UVA radiation is significantly increased by the presence of the foundation make-up 15 mn and 2 h after application. This result confirms that the tested product is capable of protecting the skin of the face and constitutes an element in the fight against ageing of the skin produced in particular by the UVA of solar radiation.

Another application allows the spontaneous capacity of the skin to reflect UVA according to the phototypes to be quantified.

The usual classification according to phototype, set out below, is not really the result of any quantification but of qualitative and arbitrary observations.

The + signs used in this Table indicate, according to their number, the importance of the parameter of the column in question as far as the phototype is concerned.

These phototypes correspond to a classification according to the behaviour of the skin in relation to solar

radiation.

Photo-type	hair	flesh tint	freckling	sunburn	suntanning
0	white	albino	0	constant+++	0
I	red	milky	+++	constant++	0
II	fair	pale	++	constant +	slight tan
IIIA	fair	pale	+	frequent	light tan or
IIIB	auburn	matt	+	frequent	deep tan
IV	brown	matt	0	rare	dark
V	brown	matt	0	exceptional	very dark
VI	black	black	0	absent	black

A group of 31 people belonging to the phototypes II, III and IV was investigated by measuring the UVA reflection capacity with an apparatus in accordance with the invention.

The results of this investigation are schematically represented in Figure 7 by three points representing the mean values for the phototypes II, III and IV interspaced along the X axis.

For the phototype II, the mean value is established at a mean reflection percentage of 35.6%.

For the phototype III, the mean value is established at 32.88%.

For the phototype IV, the mean is established at 29.65%.

The higher the phototype, the lower the diffused reflection because high phototype subjects have an epidermis rich in melanin that are more capable of absorbing the UV radiation.

Thus this investigation permits a quantitative differentiation of the phototypes; indeed, the apparatus

quantifies the skin's ability to react to the UV waves and this quantification is independent of any qualitative assessments.

The apparatus in accordance with the invention is portable and allows the measurements to be quickly and easily taken in vivo or in vitro. The medium may be a biological medium (horny layer, nails) or chemical (cellulose acetate, layers of collagen).

CLAIMS

1. A method for quantifying the behaviour, in relation to solar radiation, of skin on which a cosmetic product has optionally been applied, comprising illuminating with UVA radiation a zone of the skin to be examined, and measuring the intensity of the UVA radiation reflected along a direction inclined at an angle different from the angle of specular reflection, so as to eliminate the specular reflection to the maximum extent and to evaluate essentially the diffused reflection.

2. A method according to Claim 1, wherein the incident beam of the UVA radiation is directed along a direction normal to the zone to be examined, and the intensity of the reflected UVA radiation is measured along a direction of 45° in relation to the incident direction.

3. A method according to Claim 1 or 2, wherein the zone of the skin to be investigated is illuminated for a period of less than 1 minute.

4. A method for quantifying the behaviour of skin, substantially as hereinbefore described with reference to the accompanying drawings.

5. An apparatus for quantifying the behaviour, in relation to skin radiation, of skin on which a cosmetic product has been applied comprising a source of UVA radiation disposed so that its beam is directed towards the zone of the skin to be investigated, and at least one reflection photoreceiver disposed so as to receive the UVA radiation reflected by the skin along an inclined direction allowing the specular reflection to be eliminated to the maximum extent, and to evaluate essentially the diffused reflection.

6. An apparatus according to Claim 5, wherein the axis of the light source is disposed orthogonally to the surface of the zone of the skin to be investigated, whilst the or each reflection photoreceiver is orientated along a direction inclined at an angle of approximately 45° in

relation to the axis of the light source.

7. An apparatus according to Claim 5 or 6, wherein the light source is constituted by a halogen lamp with a wide spectrum and high output for a small size, said lamp producing a diffused light.

8. An apparatus according to Claim 7, wherein the halogen lamp is combined with a UVA filter capable of allowing only UVA radiation to pass.

9. An apparatus according to any one of Claims 5 to 8, wherein provision is made for several reflection photoreceivers to measure the reflected intensity, these photoreceivers being disposed at regular angular intervals around the axis of the light source.

10. An apparatus according to claim 9 wherein there are eight of said photoreceivers.

11. An apparatus according to any one of Claims 5 to 10, and comprising incident photoreceiver means capable of measuring the intensity of the light emitted by the source.

12. An apparatus according to any one of Claims 5 to 10, wherein it comprises a head comprising a cylindrical casing provided in its upper part with a halogen lamp and in its lower half with a support for:- (i) radially orientated incident photoreceivers recessed in a cylindrical wall of the said support, (ii) the UVA filter disposed against a constriction of the support, and (iii) a sleeve comprising inclined cylindrical ducts regularly interspaced in correspondence with the reflection photoreceivers.

13. An apparatus according to any one of Claims 5 to 12, and further comprising a timing unit actuated by a push button and capable of illuminating the light source for a relatively short period.

14. An apparatus according to Claim 13, and further comprising memory means, provided with digital display units capable of storing and displaying the data relating on the one hand to the emitted intensity, and on

the other hand to the reflected intensity before the source is extinguished, and calculating means for establishing from these data a reflection percentage of the UVA radiation by comparison with a predetermined scale.

15. An apparatus for quantifying the behaviour, in relation to solar radiation, of skin to which a cosmetic product has been applied, such apparatus being constructed and adapted to operate substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

16. The application of a method according to any one of Claims 1 to 4 for the establishment of a quantified classification of the skin related to phototypes.

17. Application of a method according to any one of Claims 1 to 4 to the quantification of the capacity of a product applied to the skin for its protection against solar radiation, its persistence and its endurance.

18. Application of a method according to any one of Claims 1 to 4 to the determination of the protection index of a product in relation to UVA.

Published 1991 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from Sales Branch, Unit 6, Nine Mile Point, Cwmfelinfach, Cross Keys, Newport, NP1 7HZ. Printed by Multiplex techniques ltd, St Mary Cray, Kent.